

to me to ignore the fact that both structures arise in similar positions, viz. at the bases of the limbs. The thoracic tracheæ of *Galeodes* open posteriorly on the coxa of the second pair of legs. In addition, then, to the extreme improbability of the same structure—tracheæ—having had two independent origins in the same animal, we have the further improbability that the openings of the assumed independently developed thoracic tracheæ should bear apparently the same relation to the thoracic limbs as the lungs do to the embryonic abdominal limbs.

These arguments, I think, lend considerable support to my attempt to deduce tracheæ from setiparous glands. The first two points seem to show that the lateral row of stigmata, spinning-glands, &c. found in the Myriapoda and Hexapoda have actually been deduced from the acicular glands of dorsal parapodia, the ventral parapodia forming the legs. Such a confirmation of this part of my original suggestion leads us almost naturally to conclude that the ventral row of tracheæ, spinning-glands, &c. in the Arachnida have been developed from the setiparous glands of the ventral parapodia. If so, the legs of the Arachnids have been most probably developed from the dorsal parapodia, while the ventral parapodia have disappeared in the coxal joints, their setiparous glands, however, persisting as tracheæ &c. This origin of the limb in the Arachnids is exactly what I have elsewhere endeavoured to show must have been the origin of the legs of the Crustacea. This would account for the great similarity between the legs of *Limulus* and those of the Arachnids, and also for their common possession of coxal glands. It would also account for the traces of Crustacean characters found by Jaworowski\* in the developing limbs in the embryo of *Trochosa singoriensis* †.

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IV.—On the Terminal Organ of the Pedipalp of *Galeodes* and the Discovery of a Homologous Organ on the Pedipalp of *Phrynus*. By HENRY M. BERNARD, M.A. Cantab. (from the Huxley Research Laboratory).

THE remarkable protrusible organ at the tip of the pedipalp of *Galeodes* has, since Dufour's discovery, received but little

\* "Ueber die Extremitäten, deren Drüsen, und Kopfsegmentirung bei *Trochosa singoriensis*," Zool. Anz., May 1892.

† I regret to have omitted to mention in my former paper what had been a very valuable work of reference to me, viz. Palmén's 'Zur Morphologie des Tracheensystems,' Leipzig, 1877.

attention. Dufour \* himself assumed that it was a sucker-like seizing-organ, and this view has again been expressed quite recently †.

A close examination of it shows almost conclusively that Koch's ‡ suggestion that it is a sensory organ, probably olfactory, is correct.

We may at the outset remark, first, that such a minute and delicate seizing-organ in an animal armed like *Galeodes* would be ridiculously out of proportion, and, secondly, that a highly specialized sensory organ might be expected in such swift runners who hunt their prey.

The organ itself is essentially an invagination of the tip of the pedipalp, forming a conical pit, the thin chitinous walls of which are continued into the metatarsus as a tendon to which a powerful muscle is attached. The external aperture of the pit is a transverse slit, which closes like a pair of lips. The upper lip, *i. e.* that on the dorsal or outer side of the limb, is stiff and solid, and is opened by means of a long tendon connecting it with a muscle far down in the metatarsus. The opening of this lip like a lid leads apparently to the slight protrusion of the organ, *i. e.* by drawing it up with it. I could find no other mechanism to explain it.

Within the pit one wall only, *i. e.* the dorsal, is thickly covered with fine sensory hairs, so regularly arranged that the chitinous membrane from which they arise appears like a fine network. The hairs are in evident connexion with a deep sensory epithelium immediately under the chitinous membrane. This epithelium runs a long way down the (hollow?) tendon. The ventral wall of the pit is an exceedingly fine chitinous membrane, against which, when the aperture is closed, the tips of the hairs apparently rest.

If this is not enough to show that this organ is not a seizing but a sensory organ, the discovery of a very similar organ in the pedipalps of *Phrynus* on the inner surface of the most distal claw effectually settles the question. In the adult specimens a sensory area runs longitudinally from the joint along about half the length of the claw; but I was unable to discover any chitinous invagination. In a young specimen, however, which could be clarified, an invagination of this same area was very clear. It occurred on the dorsal side of

\* Dufour, "Anatomie, histologie, et physiologie naturelle des *Galéodes*," Mémoires présentées à l'Institut de France, vol. xvii.

† Bertkau, "Ueber Sinnesorgane in den Tastern und in den ersten Beinpaar der Solpugiden," Zool. Anz., Jan. 1892.

‡ Koch, "Systematische Uebersicht über die Familien der Galeoden," Archiv für Naturgesch., 1842.

the area, and was so arranged that the sensory surface seemed to dip away sideways under the cuticle of the claw, and could then be followed under the microscope through the base of the claw into the next joint. The lower ventral edge of the exposed part of the sensory organ was protected by hairs regularly arranged so as to slant over the delicate surface, while dorsally, where the sensory surface disappears under the cuticle, the slit-like opening is guarded by a regular row of fine hyaline hairs, which rise from the sensory surface and curve over the outer cuticle. Apparently similar hyaline hairs can be focussed down in the lower parts of the invagination. On both old and young curious hairs with heads like narrow dentate leaves occur at each end of the sensory area\*.

The finer histological details of this organ in *Phrynus* can only be made out in young specimens when the chitin is not too thick for sectioning. I reserve further details of the organ in *Galeodes* for a comprehensive work which I am now preparing on this animal.

The presence of this presumably olfactory organ in such different Arachnidan types as *Galeodes* and *Phrynus* is of no small interest. The clarified pedipalp of *Scorpio* showed no trace of such olfactory organs. The same must be said of a Chernetid, apparently an *Obisium*, which had been boiled in caustic potash. The pedipalp of a *Telyphonus* was also searched in vain by clarifying rough sections. I unfortunately had no young specimens of this latter at my disposal. It seems to me not improbable that some traces of such an organ might be found in very young animals considering the apparent affinity which exists between *Phrynus* and *Telyphonus*.

Whether the peculiar sexual organs at the end of the pedipalp of the Araneids had any original connexion with such a sensory organ is a point well worth investigating.

#### V.—On the Embryology of the River-Lamprey.

By PH. OWSJANNIKOW †.

MODERN methods, including both serial sections and also the new staining reagents, now enable us to prosecute a much

\* As an index of the accuracy of Koch's figures, the position of this organ is marked by a group of hairs in the drawing of *Phrynus ceylonicus*, plate 776 in vol. x. 'Uebersicht der Arachniden-Systeme.'

† Translated from the 'Mélanges Biologiques tirés du Bulletin de l'Académie Impériale des Sciences de St.-Petersbourg,' t. xiii. livr. i. St. Petersburg, 1891: pp. 55-67.